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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/855,506	05/16/2001	Koichi Kamon	44084-494	9434

7590 12/10/2004  
MCDERMOTT, WILL & EMERY  
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EXAMINER

STREGE, JOHN B

ART UNIT	PAPER NUMBER
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2625

DATE MAILED: 12/10/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/855,506

Applicant(s)

KAMON ET AL.

Examiner

John B Strege

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 22 July 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☐ Claim(s) 1-7 and 9-22 is/are rejected.
- 7) ☒ Claim(s) 8 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 16 May 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

***Response to Arguments/Amendment***

In response to applicants' amendment received 7/22/04, all requested changes to the specification and the claims have been entered. Claims 20-22 have been added.

Applicant's arguments regarding the USC 112 rejection has been fully considered but is not persuasive. Regarding claim 2, Applicant argues on pages 12 and 13 that in one frame the output of the area sensor when the active/inactive timing of the area sensor is controlled will be such that the amount of exposure of the area sensor is dependent on the light propagation time, and that in the subsequent frame the output of the area sensor is based upon just environmental light when the active/inactive timing of the area sensor is controlled such that the amount of exposure of the area sensor is independent on the light propagation time. However, within the claim there is no distinction regarding that this is occurring in separate frames or that only environmental light is used in the second frame. Thus without these distinguishing features the claim continues to be contradictory and the rejection as such stands.

***Claim Rejections - 35 USC § 112***

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 2 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 2 discloses contradictory information in that the

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exposure of the area sensor is dependent on the light propagation time, and the exposure of the sensor is independent of the light propagation time.

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claim 1, 3-5, 11-20, and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yahav et al. USPN 6,091,905 (hereinafter "Yahav").

Claim 1 discloses, "a three-dimensional measurement method for measuring a distance to a plurality of positions on an object by projecting light and receiving light reflected from the object, said three-dimensional measurement method comprising the steps of: projecting a light on an object; receiving light reflected from the object by an area sensor comprising a plurality of photoelectric conversion elements; controlling the active/inactive timing of the area sensor such that the photoelectric conversion elements are exposed to light reflected from the object and a sensitivity of the area sensor is varied, synchronously with a modulation period of light projection which are periodically modulated in a frame; and measuring the distance to each photoelectric conversion element based on the output of the area sensor."

Yahav discloses a three-dimensional camera, and a system for accurately determining the distance to various objects and portions of objects in a scene (col. 1 lines 4-8). A source of radiation 10 (figure 1) directs radiation at the scene (col. 3 lines 8-9). This radiation is visible or infrared radiation, such as laser radiation or stroboscopic light (col. 3 lines 16-17). Yahav further states that one can use both continuous radiation and pulsed radiation (col. 6 lines 29-31). The system further includes a detector to receive the radiation reflected from the object in the scene (col. 3 lines 19-20). The detector may be any suitable detector with a suitable number of gray levels including, a photographic camera (i.e. a still camera), electronic camera, video camera, or a CCD camera (col. 3 lines 22-26). A CCD has a plurality of photoelectric conversion elements. Yahav further discloses that the simultaneous control of the source modulator 16 and detector modulator 18 may be synchronous so that the operation of both radiation source 10 and detector 12 is affected in the same way at the same time, i.e., synchronously (col. 4 lines 14-26). Yahav further discloses that the radiation source and detector 12 may be open for different durations during each cycle and/or the unblocking of detector 12 may lag the unblocking of radiation source 10 during each cycle (col. 4 lines 14-33). The detector being blocked and unblocked within a cycle corresponds to changing the sensitivity of the detector. Finally the system further determines the distances to various objects and portions of objects in the scene being examined (col. 4 lines 36-39).

Although Yahav does disclose periodic modulation of the light projection in cycles (figures 2-4), he does not explicitly disclose that this occurs in a frame. However Yahav

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does disclose that the invention may be used with a photographic film camera, or CCD camera, or video camera (col. 3 lines 22-26). As a photographic camera takes a picture one frame at a time it would be obvious to one of ordinary skill in the art that the procedure described in col. 4 lines 14-33 would occur in a frame.

Regarding claim 3, Yahav discloses that during each cycle, both laser 10 and reflected radiation are active for a time a and are inactive for a time b. The times a and b may be the same or different (col. 5 lines 2-5).

Regarding claim 4, as seen in figures 2, the CCD follows a cycle where it is active for a time period a and inactive for a time period b, thus an exposure would be obtained for each time period a giving multiple exposures.

Regarding claim 5, as seen in figure 3 Yahav discloses that radiation source may be modulated harmonically (col. 5 lines 57-59). Thus a plurality of exposures is obtained within a period of pulse light projection.

Regarding claim 11 Yahav discloses controlling the sensor so as to activate to be exposed to light reflected from the object and a sensitivity of the area sensor is varied, synchronously with a modulation period of light projection which is periodically modulated (col. 4 lines 8-39). The limitation that this occurs in a frame has been addressed above with claim 1, thus the same argument applies.

Regarding claim 12-14, as can be seen in figure 2 the time period is repeated a number of times (multiple time frames) and the sensing time period is repeated to synchronize with the emission time period in the time frame. As stated above a distance data is obtained by the electric signal. Furthermore as Yahav discloses the blocking of

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the detector during the time frame  $b$  the distance data is uninfluenced by environmental light in this section.

Regarding claim 15, Yahav discloses that during each cycle, both laser and reflected radiation are active for a time  $a$  and are inactive for a time  $b$ . The times  $a$  and  $b$  may be the same or different (col. 5 lines 2-5).

Claim 16 has similar limitations to claim 1, thus the same arguments used for claim 1 apply equally to claim 16.

Regarding claim 17, Yahav discloses that the detector may be a CCD camera (col. 3 line 26).

Claim 18 is dependent on claim 16. Yahav does not explicitly disclose that the sensor uses a metal-oxide semiconductor.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a metal-oxide semiconductor as a sensor. Applicant has not disclosed that using a metal-oxide semiconductor provides an advantage, is used for a particular purpose or solves a stated problem. One of ordinary skill in the art, furthermore, would have expected Applicant's invention to perform equally well with a CCD because it also detects the intensity of the light.

Regarding claim 19, a CCD has a plurality of pixels, and furthermore Yahav discloses compensating for reflectivities by dividing the intensity of each pixel during the continuous period by the intensity of the same pixel during the pulsed period (col. 6 lines 45-50).

Regarding claim 20, Yahav discloses that the radiation source may be modulated as shown in figure 3 (col. 5 lines 54-59).

Claim 22 discloses similar limitations to claim 1 addressed above. Thus the same argument used for the rejection of claim 1 apply equally to claim 22.

5. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Netzer USPN 5,930,383 in view of Uomori et al. USPN 6,587,183 (hereinafter "Uomori").

Figure 5 of Netzer discloses a three-dimensional measurement method for measuring a distance to a plurality of positions on an object by projecting light and receiving light reflected from the object comprising the steps of:

sequentially projecting light of a first luminance distribution and light of a second luminance distribution on an object (abstract and col. 1 lines 50-57);

receiving light reflected by the object in each projection cycle by a solid state area sensor comprising a plurality of photoelectric elements ((CCD camera 30 comprises a plurality of pixels); and

measuring the distance to each photoelectric element based on the output of the solid state area sensor in a first projection and the output of the solid state area sensor in a second projection (col. 1 lines 63-67 and col. 6 lines 59-67).

Netzer does not explicitly disclose that the first distribution is an uneven distribution and light of the second distribution which is uneven distribution being different from the first distribution.



Uomori discloses a range finder device for measuring with a plurality of projected lights having radiation patterns whose light intensity differs (col. 3 line 29 – col. 4 line 3 as seen in figure 4). Using this method provides for excellent accuracy in measuring the distance (col. 24 lines 47-50).

Netzer and Uomori are analogous art because they are from the same field of endeavor of distance measurement.

At the time of the invention it would have been obvious to one of ordinary skill in the art to combine Netzer and Uomori to project two different luminance distributions on an object. The motivation for doing so would be to improve the accuracy of the distance measurement. Thus it would have been obvious to one of ordinary skill in the art to combine Netzer and Uomori to obtain the invention as disclosed in claim 10.

6. Claims 6, 9, and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yahav et al. USPN 6,091,905 in view of Netzer USPN 5,930,383.

The projector and sensor limitations have already been discussed in the above rejection of claim 1. Yahav further discloses a mechanism for controlling the source modulator 16 and detector modulator 18 to be synchronous (col. 4 lines 14-28). Yahav further discloses alternate activating and deactivating of radiation source 10 and the detector 12 (col. 3 lines 37-40).

Yahav does not explicitly disclose that the controller obtains at least two frame images, however does disclose that a video camera may be used (col. 3 lines 23-26) thus it would be obvious that more than one frame can be obtained. Furthermore

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Yahav does not disclose a processor for eliminating the fluctuating component of the received light intensity due to distance or reflectivity of the object from the amount of exposure obtained based on the ON/OFF control by use of the two frame images. Yahav discloses that dividing the intensity of each pixel during the continuous period by the intensity of the same pixel during the pulsed period can compensate for differences in reflectivity of the object (col. 6 lines 39-49).

Netzer discloses a three-dimensional depth sensing camera (col. 1 lines 5-10) and teaches that in certain applications it may be preferable to perform a number of calibration cycles (multiple frames)(numeral 38 discloses a frame grabber and video processing) to ensure that any systematic errors caused by reflections or the like are automatically canceled out (col. 7 lines 47-54). Furthermore Netzer discloses that the invention may be implemented in a number of different forms without requiring any significant adaptation (col. 7 lines 65-67).

Yahav and Netzer are analogous art because they are from the same field of endeavor of 3-d distance measuring cameras.

At the time of the invention it would have been obvious to one of ordinary skill in the art to modify Yahav to capture multiple frames in order to use them to eliminate problems due to reflectivity as taught by Netzer. The motivation would be to cancel out any systematic errors caused by the reflectivity. Thus it would have been obvious to one of ordinary skill in the art to combine Yahav and Netzer to obtain the invention of claim 6.

Regarding claim 9, since the detector device of Yahav is a CCD and the modulation is done harmonically it would be obvious to one of ordinary skill in the art that the control of the photoelectric elements is accomplished differently for each line of the area sensor.

Regarding claim 21, Yahav discloses that a wide variety of the controlling of the detector is possible (col. 4 lines 23-33) thus it would be obvious to control the On/off state in a different manner in different frames for calibration purposes.

7. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yahav et al. USPN 6,091,905 in view of Netzer USPN 5,930,383 and further in view of Tanaka USPN 6,252,655.

Yahav & Netzer disclose the limitations of claim 6.

Yahav or Netzer do not disclose expressly an internal optical path, wherein the measurement value is corrected in accordance with the amount of exposure.

Tanaka states that there is a reflectivity problem in the prior art that makes it difficult to measure the distance of an object with high accuracy (col. 1 lines 42-55). To solve this problem Tanaka discloses an internal optical path that is used for obtaining a predetermined standard level employed for light quantity equilibration (col. 1 lines 51-54 and lines 65-67). This equilibration can be read as a correcting of the light.

Yahav, Netzer, and Tanaka are combinable because they are from the same field of endeavor of distance measuring.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use an internal optical path with the invention of Yahav and Netzer to correct the measurement value in accordance with the amount of exposure.

The suggestion/motivation for doing so would have been to solve the problem caused by highly reflective objects.

Therefore, it would have been obvious to combine Yahav and Netzer with Tanaka to obtain the invention as specified in claim 7.

***Allowable Subject Matter***

Claim 8 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

***Contact Information***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John B Strege whose telephone number is (703) 305-8679. The examiner can normally be reached on Monday-Friday between the hours of 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta can be reached on (703) 308-5246. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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